

A clinical comparison of antibacterial mouth rinses in orthodontic patients

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ABSTRACT

This clinical investigation was undertaken to compare the antibacterial activity of two mouth rinses (chlorhexidine digluconate 0.2% and phenolic compounds) with salty water (0.9% NaCl) to assess their ability to control plaque and gingival inflammation in conjunction with a normal daily home care in patients with fixed orthodontic appliance. In this clinical trial, 45 patients were randomly divided into three groups; each containing 15 persons matched in age and gender, they were instructed to use rinses twice daily for 30 seconds after breakfast and before the bedtime. The gingival and plaque indices were measured according to Silness and Loe for the six teeth at the baseline and two months after rinses.

The results of the study revealed that there is a significant reduction at $p < 0.05$ after rinsing with phenol and chlorhexidine digluconate for gingival index, while non significant change for salty mouthwash, and only significant reduction in plaque index for chlorhexidine digluconate mouth rinse and non significant one for phenol and salty mouthwashes. These results support previous published results on the superiority of 0.2% chlorhexidine digluconate when used in conjunction with professional care as an adjunct to routine oral hygiene practice in orthodontic patients.

Key Words: Chlorhexidine, phenolic compounds, antibacterial activity.

الخلاصة

أجريت هذه الدراسة السريرية لمقارنة المضاد الجرثومي لغسولي الفم (كلورهيكسيدين كلوكونيت 0.2% ومركبات الفينول) مع محلول الماء والملح (كلوريد الصوديوم 0.9%) من حيث قدراتها للسيطرة على الصفيحة الجرثومية والتهابات اللثة عند استعمالها مع الوسائل اليومية الاعتيادية لتنظيف الأسنان للمرضى المستخدمين جهاز تقويم الأسنان الثابت. تضمنت هذه الدراسة 45 مريضاً قُسموا بطريقة عشوائية إلى ثلاث مجاميع تحتوي كل مجموعة على 15 مريض متقاربين من ناحية العمر والجنس. أُرشِد هؤلاء المرضى على استعمال الغسول والمحلول الملحي مرتين يومياً ولمدة 30 ثانية لكل مرة بعد وجبة الإفطار وقبل النوم، ثم قيس مؤشرا الصفيحة الجرثومية والتهاب اللثة حسب (Silness and Loe) لسته أسنان مختارة قبل وبعد استعمال الغسول والمحلول الملحي بشهرين.

أظهرت نتائج هذه الدراسة وجود اختلاف معنوي عند مستوى معنوية 5% قبل وبعد استعمال غسولي الفم كلورهيكسيدين كلوكونيت ومركبات الفينول لمؤشر التهاب اللثة وعدم وجود اختلاف معنوي عند مستوى معنوية 5% لمحلول الماء والملح، ووجود اختلاف معنوي فقط لغسول الفم كلورهيكسيدين كلوكونيت لمؤشر الصفيحة الجرثومية بعد الاستعمال، بينما لا يوجد اختلاف معنوي لمركبات الفينول ومحلول الماء والملح. إن نتائج هذه الدراسة تؤيد نتائج الدراسات السابقة من حيث فعالية استعمال غسول الفم كلورهيكسيدين كلوكونيت عندما يُستخدم مع الطرق اليومية الاعتيادية للحصول على صحة أعلى للثة والأسنان لمرضى تقويم الأسنان.

INTRODUCTION

It has been clear that the orthodontic

appliances contribute to plaque retention and interfere with the performance of good oral hygiene.⁽¹⁾ The normal maintenance by tooth brushing only appears to be unsatisfactory, so many of chemical agents are designed to assist as adjunctive to the traditional oral hygiene maintenance procedures. There are many agents that are commercially available, but the relative therapeutic benefits of most are not clearly defined.⁽²⁾

Many previous studies have shown that chlorhexidine digluconate is an effective antiplaque agent.⁽³⁾ The safety of it been repeatedly confirmed.⁽⁴⁾

Phenolic compounds have been used since 1867 as germicides. Their use as mouth rinses produces a moderate reduction in plaque mass with no reported side effects for the thymol which is the principal antibacterial component of commercial preparation.⁽⁵⁾

The antibacterial properties of salt solutions are well documented in the literatures, and much of their activity is based upon the osmotic pressure changes which cause bacterial cell disruption and death.⁽⁶⁾ Ryder *et al.*⁽⁷⁾ have noted that exposure of several subgingival species of microflora to hypertonic salt solutions resulted in cell death.

The aim of this study was to compare the action of three mouth rinses (chlorhexidine digluconate 0.2%, phenolic compounds and salty water 0.9% NaCl) in relation to their ability to control plaque formation and gingival inflammation in conjunction with normal daily home care in orthodontic patients.

MATERIALS AND METHODS

The subjects in this study were selected from the attending patients at Orthodontic Department in Dentistry College of Mosul University, and also from orthodontic patients in the private clinics in Mosul City; all were treated with fixed orthodontic appliances.

Forty five patients were participated in this work; their age ranged between 11–17 years. An evidence of gingivitis was present, but no evidence of periodontitis; the volunteers had no history of any medical problem or current antibiotic therapy.

The volunteers were divided into three equal groups; each consisted from fifteen volunteers. At first, they were received an instruction to brush their teeth three times daily for a period of fourteen days. Using the same toothpaste (Amber) and the same brushing technique (modified Bass technique), so as to determine the baseline point.

After that, in the first group, each volunteer received a container of water with dissolved salt at concentration of 0.9%. They were instructed to brush with Amber toothpaste once at morning after breakfast and once at the evening before bedtime. They were instructed to brush for at least 3 minutes to ensure thorough cleaning of the teeth; then rinse his/her mouth with 10 ml of the solution after each brushing for 30 seconds with no any intake of food or drink for 30 minutes post-rinsing.

The same regimen was done for the second and third groups as the second group received an already prepared phenol and the third group received 0.2% chlorhexidine digluconate mouthwash (Al-Mansour Pharmaceutical Co, Iraq).

The gingival and plaque indices were measured according to Løe and Silness⁽⁸⁾ as the facial, mesiofacial, distofacial and palatal (lingual) surfaces of six teeth (3, 9, 13, 19, 25 and either 28 or 29, depending on which premolar was extracted for orthodontic purposes). This was done before the use of mouthwash –at baseline– then after a period of 2 months of the application of the mouth rinses.

The results for gingival index were recorded as occurrence of gingivitis [grade 1 (mild inflammation, slight change in colour, slight oedema, no bleeding on probing); grade 2 (moderate inflammation, redness, oedema and glazing, the gum bleeds on probing); and grade 3 (severe inflammation, marked redness and oedema, ulceration, there is a tendency for spontaneous bleeding)] or as absence of gingivitis [grade zero (normal gingiva)].⁽⁸⁾ For plaque index, the estimation of plaque accumulation is the same as for gingival index where the presence of plaque were given [grade 1 (a film of plaque adhering to the gingival margin and the adjacent area of the tooth. The plaque may only be recognized by running a probe across the

tooth surface); grade 2 (a moderate accumulation of soft deposits within the gingival pocket or on the tooth and gingival margin. This can be seen with the naked eye); and grade 3 (an abundance of soft matter within the gingival pocket or on the tooth and the gingival margins)] and absence of plaque gives grade zero (no plaque in the gingival area).⁽⁸⁾

Statistical analysis in this study was the descriptive analysis (mean and standard deviation), and one-way analysis of variance (ANOVA) among the three groups.

RESULTS

Table (1): Initial balance for subjects completing study

Treatment Groups	No.	Male / Female	Mean Age	Mean Plaque Index	Mean Gingival Index
Chlorhexidine	15	9/6	14	0.94	1.95
Phenol	15	10/5	13.8	0.90	1.89
Salty Water	15	7/8	15.3	1.10	2.28

Table (2): The plaque index for the three groups before and after the use of mouthwashes

Rinses Used	Plaque Index		t-test
	Before Mean ± SD	After Mean ± SD	
Salty Water	1.10 ± 0.32	0.96 ± 0.14	NS
Phenol	1.0 ± 0.85	0.90 ± 0.18	NS
Chlorhexidine	0.94 ± 0.14	0.68 ± 0.11	S

NS: Not significant; S: Significant; SD: Standard deviation.

For gingival inflammation and bleeding (gingival index) only non significant reduction was found in salty water mouthwash group while significant reduction was found in both chlorhexidine digluconate and phenol mouth rinses as shown in Table (3). In addition to that, significant difference among study group as F ratio

All groups were well-balanced at the beginning of the study with respect to age, gender, initial plaque and gingivitis grades (Table 1).

There is significant reduction in plaque scores (plaque index) for each of the test groups after product use; except one product (chlorhexidine digluconate) which recorded significant reduction in plaque levels when compared to salty water and phenol as shown in Table (2). Further, there was significant difference among the study groups as F ratio was 19.04 at $p < 0.05$.

was 8.516 at $p < 0.05$.

It can be noticed in Figures (1) and (2) that chlorhexidine digluconate group had the most significant reduction in plaque and gingivitis than others, subjects who rinsed with salty water showing no marked reduction in gingival inflammation.

Table (3): The gingival index for the three groups before and after the use of mouthwashes

Rinses Used	Gingival Index		t-test
	Before Mean ± SD	After Mean ± SD	
Salty Water	2.28 ± 0.62	2.17 ± 0.43	NS
Phenol	1.89 ± 0.34	1.60 ± 0.33	S
Chlorhexidine	1.95 ± 0.57	1.34 ± 0.32	S

NS: Not significant; S: Significant; SD: Standard deviation.

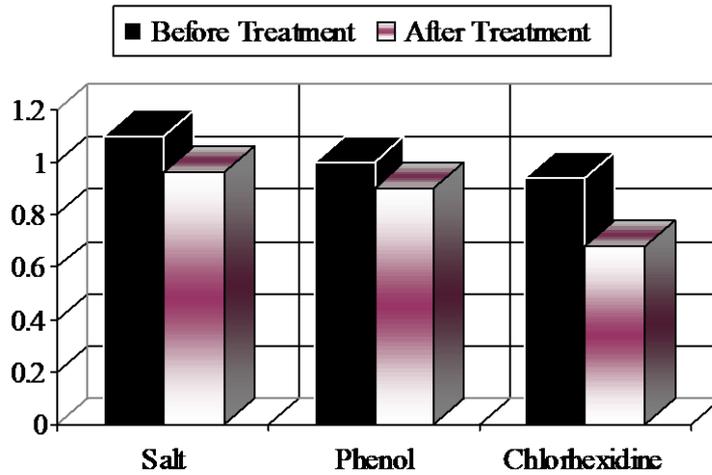


Figure (1): The plaque index for the groups before and after treatment

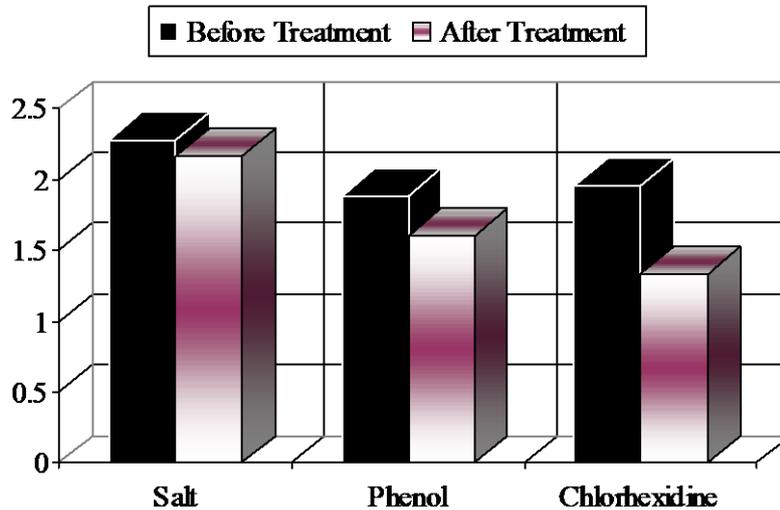


Figure (2): The gingival index for the groups before and after treatment

DISCUSSION

Mechanical tooth cleaning is a skill that many persons are unable to do in perfect manner, the addition of full bonded or banded fixed appliances increases the difficulty of this task and therefore produces more gingival and periodontal problems in most of orthodontic patients.⁽⁹⁾

As the orthodontic appliances will result in inherent irregularities, these provide additional opportunities for collection and retention of food which permits luxuriant bacterial growth and accounts for the increased concentration of bacteria in plaque.⁽¹⁰⁾

For these reasons, it would be of great clinical benefit if a chemical agent could

be used during the active phase of orthodontic treatment. But it is important to remind the patient that the chemical agents are not substitute for the thorough brushing and interproximal cleaning.

This study is a clinical attempt to make a comparison for the anti-plaque and anti-gingivitis effect of two commercially available oral antiseptics (phenol, chlorhexidine digluconate) and salty water mouth rinses in accompanied with tooth brushing.

In this work, the chlorhexidine digluconate had the most potent plaque inhibiting effect. This was in agreement with several studies,⁽¹⁰⁻¹⁵⁾ and in disagreement with other study which was done by Lund-

strom *et al.*⁽¹⁶⁾ who found non significant improvement in oral hygiene when use chlorhexidine digluconate mouth rinsing for a period of three weeks.

In a similar study done by Lamster *et al.*⁽¹⁷⁾ involving 129 subjects, the phenolics were used twice daily under supervised conditions compared to control. Significant reductions in plaque and gingivitis were observed and ranged from 14% to 28% for plaque, and 5% to 28% for gingivitis; while in the present study the non significant reduction was 10% for plaque and 29% significant reduction in gingivitis.

Grossman *et al.*⁽²⁾ in a 6 months study on 481 adults comparing the effect of chlorhexidine digluconate, phenolic and sanguinarine on dental plaque and gingivitis. The phenolic compound showed moderate significant reduction in plaque compared to placebo (24%), while non significant effect on gingivitis (15.9%) was noticed.

Several long term studies have demonstrated a 19.5–51% reduction in plaque score and a 24–51% reduction in gingivitis score when phenolic was used as a supplement to mechanical plaque control.^(17, 18) But in this study, non significant reduction was 10% for plaque and 29% significant reduction for gingival inflammation.

Some patients find an initial brushing sensation and bitter taste, and this is consistent with the results of other study.⁽¹⁹⁾ However, accommodation usually occurs in few days.

The results of this study are consistent with other study⁽²⁰⁾ regarding the non significant reduction in gingival and plaque scores for the group using salty mouth-wash.

CONCLUSIONS

Chlorhexidine digluconate mouth rinse was still the more potent one in comparison with the phenolic compounds and the most popular mouth rinse (salty water), but this has many side effects like discoloration of anterior restorations, burning sensation of tongue and irritation of palatal mucosa for some patients. So, its use for prolonged period of time like

orthodontic therapy appears to be difficult; so the need for evaluation of other types of mouth rinsing agents appear to be mandatory.

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